

Local Knowledge and Practice of Entomophagy in Datengan Village, Kediri, East Java, Indonesia

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Abstract: Malnutrition is one of the serious problems encountered by Indonesia. This research aimed to identify local knowledge and practice on entomophagy in Datengan Village, Kediri, East Java, Indonesia. The entomophagy data were collected by the qualitative approach. The edible insects in this study were honey bees (i.e., *Apis mellifera*, *A. cerana*, and *A. dorsata*) and flying termites (i.e., *Macrotermes gilvus* and *Odontotermes javanicus*). All aspects of the local and scientific name, halal status, harvest period, local value, and how to collect, prepare, cook and serve have been described in this article. There are two arguments about consuming termites: haram or halal (considered a type of grasshopper). On the other hand, consuming bees (*A. mellifera*, *A. cerana*, and *A. dorsata*) is haram to eat adult bees. Meanwhile, consuming bees that are still in the form of larvae is halal, but it is to be haram if they are eaten separately with honey or hive. Both termites and bees were not cultivated and processed into several types of foods such as fried, *bothok*, and *rempeyek*. There were five challenges in entomophagy such as disgust, allergy, inferior, halal status, and complicated processing methods.

Keywords: Community consumption, edible insects, food security, nutritional deficiency, protein sources

1. Introduction

Up to this time, the problem of malnutrition in Indonesia remains a significant challenge in building the next high-quality Indonesian generations for the forthcoming [1][2][3]. Reflecting on the 2018 Basic Health Research performed by the Research and Development Department of the Indonesian Ministry of Health, malnutrition and undernutrition in children under five in Indonesia reached 17.7%, while stunting reached 30.8%. Malnutrition, in all its forms, including nutritional deficiency (wasting, stunting, underweight), could damage the body's immunity to various diseases, especially infectious diseases that interfere with growth, physical and mental development [4]. To minimize the incidence of future malnutrition in the nation, efforts to explore alternative food sources should be continuously pledged to boost the protein intake of the community. One of the potential alternative food sources is insects, which are

nutritious and contain high protein but are not commonly consumed by Indonesian people [5]. Insects can also be cultivated at a low cost, and their population is often abundant in nature.

For thousands of years, humans have harvested the eggs, larvae, pupae, and adults of certain insect species from their habitat for consumption. According to the Oxford Dictionaries Online, entomophagy means 'the practice of eating insects, especially by people'. The term "entomophagy" came from the Greek term "entomos" (meaning: insects) and "phagein" (meaning: to eat), thus the combined words mean "insect-eating" [6][7]. Many ethnic groups in Africa, Asia, South America, and Mexico recognize edible insects as sustainable food items, particularly in rural communities [8]. Thailand is an example country with a successful commercial insect sector that produces primarily for human consumption [9]. Edible insects sold the most commonly marketed and consumed in Thailand are locusts, giant water bugs, crickets, palm weevil larvae, bamboo caterpillars, beetles,

and ants. On the other hand, in Thailand and Laos the consumption of edible insects declines due to westernization [10]. In Indonesia, edible insects are still rarely consumed, and otherwise, they have been reported as unique culinary in the country [11][12].

Protein is a complex organic compound consisting of amino acids linked by peptide bonds. This molecule plays an essential role in forming the structure, function, and regulation of living cells, and has many parts and benefits for the development of our bodies. Protein is contained in various types of food, such as insects [13]. Edible insects have protein, vitamin contents, minerals, and fat to fill the requirements of healthy food, despite it being influenced by collection sites, insect species, insect life stage, processing method, insect feed, and rearing technology [14]. However edible insects are usually not relatively rich in carbohydrates and deficient in amino acids [15][16]. The nutrient contents (proteins, vitamins, fats, and essential minerals) in edible insects cannot be generalized since it relies on gender, species, developmental stage, the environment (humidity, temperature, and photoperiod), diet, and the analytical methods used [7].

Kediri is one of the regencies located in East Java province in Indonesia, which is dominated by Java ethnic groups (Javanese) and the Moslem religion. The Javanese are the largest ethnic group in Indonesia originating from Central Java, East Java, Yogyakarta Special Region, Indramayu Regency, Cirebon Regency/City (West Java), and Serang-Cilegon Regency/City (Banten). The majority of Javanese work as farmers. While in urban areas, they work as civil servants, employees, traders, businessmen, and others. Foods of Javan ethnic have different characteristics and characteristics that differ for each region. Typical foods from Central Java and Yogyakarta tend to like sweet-tasting dishes. In addition, the people of Central Java use garlic as the dominant seasoning. East Javanese cuisine tends to use shrimp paste and *petis* (a condiment of fermented fish or shrimp) to create a spicy taste in the dish. East Java cuisine is mostly processed by boiling, frying, peppering, and grilling.

In the present study, we explore the local knowledge and practice of entomophagy in Datengan Village, Kediri, East Java, Indonesia. The Datengan community has a long history of entomophagy practices related to beliefs, social, and cultural values. A preceding study in Datengan Village showed that there are 27 plant-rich protein sources, two fermented foods, two mushrooms, and six by-product foods that were used as protein sources in the area [17]. The result of local knowledge of protein sources from edible insects can be integrated between ethnobotany, bioprospecting, conservation efforts, and market access for sustainable protein consumption [18].

2. Material and Methods

2.1. Study Area

The current study was carried out in the Datengan Village in Grogol sub-district, Kediri district, East Java province, Indonesia. The village has three hamlets, namely Datengan, Summersari, and Semen. Datengan Village is located at a latitude of -7.73921 S 7° 44'21.5826" and a longitude of 111.99176 E 111°59'30.30918". The majority of the community's livelihoods are farmers (Figure 1). Datengan Village is a lowland with spacious areas used for farming activities. The distance between the village and the city center is approximately 15-30 minutes via motorbike or car. The religion's majority of the people in the village are Moslem, and Javanese cultures are still practiced by many people in the Datengan Village in their daily lives.

2.2. Data Collection

The data on local knowledge of entomophagy in Datengan Village were collected between November and December 2021. Primary informants were selected using the snowball sampling method. With this method, an informant can diverge into multiple informants who know the local knowledge and practice of entomophagy. The data were collected by the qualitative approach (i.e., observation, semi-structured interview, and participant observation) [19]. It was used to discover local knowledge of entomophagy in the Datengan Village. An in-depth interview with local experts was conducted using a semi-structured interview. Informants were Family Welfare Programs (in Indonesian known as Pendidikan Kesejahteraan Keluarga/ PKK) members, village administrators, households, and elders. A total of 8 key informants were selected using the snowball method. The majority of the gender was female. The key informants were local inhabitants aged ± 60 years old and their background education was senior high school and university. The in-depth interview was performed according to the prepared interview guidance with a list of questions related to the topic of the study. The local name, harvest period, and method to collect, prepare, cook and serve were carefully recorded during the interviews with the respondents. The questionnaire was constructed based on the questions: What kind of edible insect is usually consumed? Are those foodstuffs available (abundant and affordable)? Why it is rarely consumed? How to cook, components, how to prepare, how to cook, and how to serve? Are there any special occasions to serve? Are these foods still acceptable and preferable? The scientific name of the identified species was analyzed based on the morphological characteristics. The specific characteristics were referred with the insect book [20]

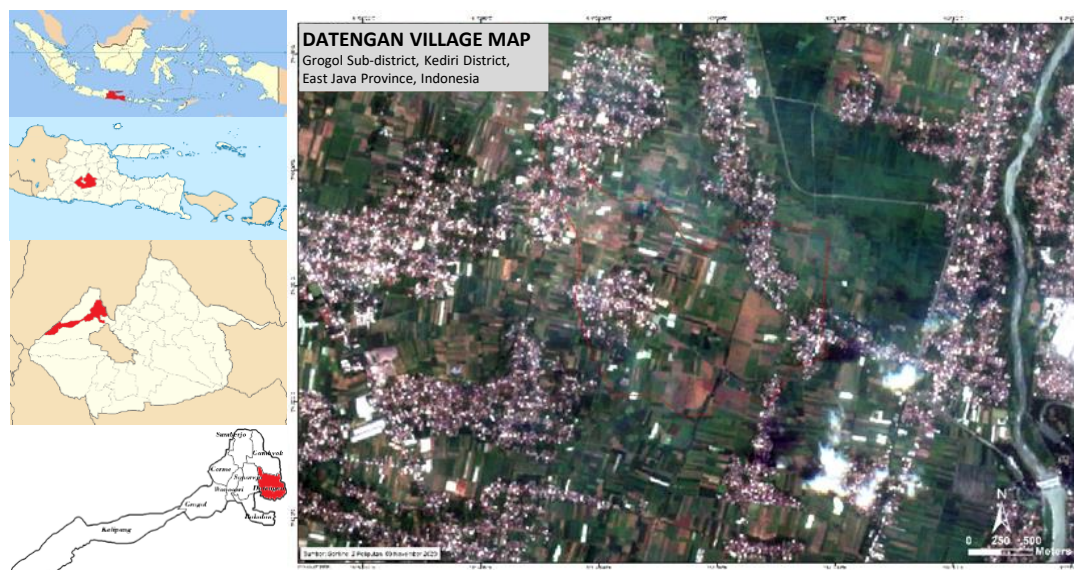


Figure 1. The Map of Datengan Village, Grogol Sub-district, Kediri District, East Java Province, Indonesia.

3. Results and Discussion

3.1. Edible Insects

Some edible insects identified in this study were bees (honey bees) and flying termites (*laron*). The diversity bees were *Apis mellifera*, *A. cerana*, and *A. dorsata*. Elements of the bees consumed were the bees themselves, beehives, bee eggs, and bee larvae. On the other hand, the type of termites consumed were *Macrotermes gilvus* (great size) and *Odontotermes javanicus* (small size) (Table 1).

3.2. Halal Status

Halal status is a crucial factor in the food system in Indonesia since the majority of people's religions in the nation are Moslem [21], including in the Datengan Village. Therefore, the halal status should be a consideration while insects are intended to be consumed as food. Termites in Arabic are known as *Ardlah*. The law of consuming this animal is haram since it is classified as disgusting.

"*Ardlah* (termites) are small animals the size of half of '*adas seed*' (a type of bean), a wood-eater also known as a sarfah. This animal crawls on the earth mentioned by Allah in the Qur'an. This animal is called *Ardlah* because of its distinctive behavior on the ground, hence its name is based on the ground (*ardl*). When *ardlah* enters the age of one year, two long wings grow which he uses to fly. They can build a nice nest from the scraps of wood he collects, like spun

cobwebs hanging from the bottom up. The law of consuming *ardlah* is haram because these animals are considered disgusting." [22]

Some people think termites are halal to eat since it is considered a grasshopper thus the carcass is also permissible. This is based on the hadith:

"Two carcasses and two blood are halal for you. Two carcasses are grasshopper and fish, while two blood are spleen and liver" (Narrated by Baihaqi)

Regarding the law on consuming adult bees, "The Messenger of Allah *shallallaahu 'alaihi wa sallam* has forbidden killing four kinds of animals: ants, bees, *hudhud* birds, and *shurad* birds." (This hadith is authentically narrated by Ahmad).

As for the problem of consuming bee larvae, Sheikh Nawawi al-Bantani, in the book *Sullamunnajat*, explained:

"What it is in the beehive, at first, it is an egg, then becomes a caterpillar, then dies and becomes a bee that can fly. In its initial form, it is halal, and in later forms, it is haram, as has been determined by some *ulama*." [23]

However, the halal status of the bees is difficult to separate from the honey and are not eaten alone, as explained by Imam Ahmad Salamah al-Qulyubi in *Hasyiyah al-Qulyubi* (Beirut: Dar al-Fikr, 1995), juz IV, p. 241:

"Likewise with caterpillars that are born from foods such as vinegar or fruit, if they are eaten together with

these foods in a dead condition, then the law is halal according to *qaul ashah* since it is difficult to distinguish them. The law is different if eaten separately." [23]

3.3. Harvest Period, Collect Method, and Local Value

In the Datengan Village, termites are typically not cultivated and not for sale in the market. People collect termites in the rainy season with light sources such as lamps. Termites can be directly collected from their nest or in the evening in rainy sessions by turning on only one light and putting water in a container. Subsequently, the termite will crowd together in the container, which can already be processed for food. It is difficult to collect small termites. This will reduce the effect of allergens and extend the shelf life. Several key informants stated that termites were no longer consumed by the villagers, even by the elderly due to sensory appraisal (the fuggy taste).

On the other hand, bees are commonly collected from gardens or houses. It can be collected all year round and hunted directly from the nest. People rarely collect bees since they can sting and cause burning and swelling in the sting area. How to take bees, usually villagers call experts for this. The experts usually only take bees and their hives by covering all parts of their bodies with a long sleeve and mask. Same with termites, bees are not cultivated and not for sale in the market. Both termites and bees, they take individually and do not specifically buy on the market.

3.4. Processed Product, Handle, Cook, and Serve Method

Termites in the Datengan Village are typically cooked as *rempeyek* (a deep-fried savory Indonesian-Javanese cracker) or directly fried. Termite is handled by adding hot water/boiling in half-done or drained using the steamer. Termite can be fried using rice flour and spices (candlenut, coriander, garlic, salt, flavoring, and coconut milk) thus it becomes crispy. Termite can also be fried without rice flour or any additional seasoning. In Datengan Village, local people consume edible insects mostly seasonally. Based on information from the key informants, they only eat insects less the five times a year. Termites, only consume during when the rainy season, but for the bees, there are no special times.

Meanwhile, bees are normally cooked as fried, *rempeyek*, and *bothok* [24], [11]. The handle method of *rempeyek* is the same as the termite. If the ingredient of *rempeyek* use bee's adult thus it will be haram. In addition, the ingredients of *bothok* are hives, onion, garlic, candlenut, tomato, star fruit, aromatic ginger, sugar, salt, and flavorings. It is cooked by grinding all ingredients. After that, it is wrapped in banana leaves and steamed. For adult bees, it is not cooked because of haram status.

3.3. Challenges of Insect Consumption

People in the community of the Datengan Village do not consume edible insects in their daily life. According to Palupi et al., [11], edible insects begin to be forgotten by the local people due to the following five reasons: disgust factor, inferior, allergy, halal status, and complicated processing method.

- (1) Disgust. Based on the in-depth review, many people feel disgusted to consume those edible insects. Thus, they refused even before they started to eat it.
- (2) Allergy, the danger of parasites, and transmission of diseases. According to Demain et al. [25], some insects such as ordo Hymenoptera (i.e., bees and wasps) have been reported as the cause of insect allergy by stings. According to Grabowski & Klein [26], surveyed the counts of total bacterial (TBC) of *Enterobacteriaceae*, *Staphylococci*, *Bacilli*, yeasts, moulds, and the presence of *Salmonellae*, *Listeria monocytogenes*, and *Escherichia coli* in 38 samples of edible insects with different ways in processing, such as class I (dried and powdered) and class II (deep-fried and spiced; cooked in soy sauce), others. The result showed that dried and powdered insects (class I) exhibited markedly higher counts than the deep-fried and cooked ones (class II). Coliforms, *B. cereus*, *Aspergillus spp.*, *Serratia liquefaciens*, *Listeria ivanovii*, *Mucor spp.*, *Cryptococcus neoformans*, *Penicillium spp.* were detected in products of class I, even though all samples used were negative for *L. monocytogenes*, *salmonellae*, *Staphylococcus aureus*, and *E. coli*.
- (3) Inferiority. In this case, what people eat also depicts their social status. When people consume edible insects, they will be judged as poor people. In social terms, rich people typically consume beef, goat, and buffalo rather than insects. It is because the price of beef, goat, and buffalo meats is relatively high.
- (4) Halal status. For instance, not many communities understand that adult bees are haram. People are sometimes confused about the halal or haram status.
- (5) Complicated processing method since edible insects are uncommonly consumed; the lack of knowledge started from collecting, handling, and cooking. Factors from sensory characteristics (taste, odor, visual appearances, and texture), the plasticity of sensory perception (nutritional aspect and tradition), and economy have significant roles in the acceptance of edible insects [27].

3.6 Safety Aspects

One of the primary issues for utilizing protein from edible insects is the safety aspect. Several edible insects might contain allergens and toxins, for example, tropomyosin, larginine kinase, myosin light, and heavy chain larval cuticle protein, and troponin [28]. Based on the cross-reactivity/co-sensitization of edible insects, people who are continually exposed to insects may cause food allergies [29]. However, increasing the safety of

edible insects can be done by processing methods, namely frying, boiling, and roasting.

4. Conclusion

In conclusion, the present research was an exploratory study and is a pilot investigation. Two edible insects were used as protein sources in the Datengan Village, i.e., bees and termites. Both termites and bees were not cultivated and processed into several types of food from bees and bees such as fried, *bothok*, and *rempeyek*.

Datengan Village is classified as a fairly developed village, and they begin to forget entomophagy. It can be an indication of why not many edible insects are consumed in the area. This is also because social norms usually attribute that eating insects is disgusting and only for the poor. Furthermore, local knowledge should be concerned because it can be forever gone soon. Documentation should be executed on traditional knowledge and natural resources management and provide education to raise awareness of the young generation. Beyond that, the edible insects could also be transformed to be valuable products for further study. This would help to increase their economic values and the acceptance of the people to consume insects. For further research, there is also a need to examine the scientific aspects of clinical nutrition, social, food technology, and economic elements of entomophagy in order to acquire comprehensive knowledge.

Table 1. Local Knowledge and Practice of Entomophagy In The Datengan Village

Local name	Latin name	Halal status	Harvest period	How to collect?	How to prepare?	How to cook and serve?
<ul style="list-style-type: none"> • Bee (honey bee) • Bee • Bee hive • Bee eggs • Bee larva 	<ul style="list-style-type: none"> • <i>Apis mellifera</i> • <i>Apis cerana</i> • <i>Apis dorsata</i> 	<ul style="list-style-type: none"> • Bee: Haram • Bee hive: Halal • Bee eggs: Halal • Bee larva: Halal but must be unable to be separated from the honey/hive 	<ul style="list-style-type: none"> • Collected by hunting • Not yet cultivated • Not for sale • Difficult processing 	Bees can be collected from gardens or houses. It can be collected all year round and hunted directly from the nest	Added hot water/boiled (half done)-drained using steamer	<ul style="list-style-type: none"> • Fried • <i>Rempeyek</i>: crispy fried using rice flour and spices • <i>Bothok</i>: the ingredients are bee nest/bee, onion, garlic, candlenut, tomato, star fruit, aromatic ginger, sugar, salt, and flavourings. It is cooked by grinding all ingredients, preparing the banana leaves. After that it is wrapped and steamed until cooked
Flying termite (<i>laron</i>)	<ul style="list-style-type: none"> • <i>Macrotermes gilvus</i> (big) • <i>Odontotermes javanicus</i> (small) 	There are two opinions, haram and halal (because they are considered a type of grasshopper).	<ul style="list-style-type: none"> • Collected by hunting • Not yet cultivated • Not for sale • Difficult processing • Rainy season 	Termites can be collected directly from their nest or in the evening in rainy sessions by turning on only one light and putting water in a container. The termite will crowd together in the container, which is ready to be processed for food	Added hot water/boiled (half done)-drained using steamer	<ul style="list-style-type: none"> • Fried • <i>Rempeyek</i>: crispy fried using rice flour and spices

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